PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-324973
(43)Date of publication of application : 08.12.1998

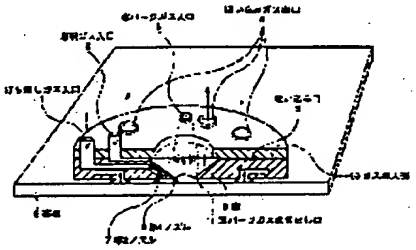
(51)Int.CI. C23C 16/44
C23C 16/48
H01L 21/205
H01L 21/3205
H01S 3/00
// H01L 21/027

(21)Application number : 09-150134
(22)Date of filing : 23.05.1997

(71)Applicant : NEC CORP
(72)Inventor : MORISHIGE YUKIO

(54) LASER CVD DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To attain the suppression of accumulations of fallen and laid deposited particle and the prevention of the intrusion of air and to prevent deviation in a gas curtain even by a purge gas.
SOLUTION: This laser CVD device has a laser light source, an irradiation observing unit irradiating a desired irradiating part on a substrate 6 arranged on a stage with laser light by the laser light source and capable of observing this irradiating part, a gas feeding unit feeding a CVD gaseous starting material to the irradiating part on the substrate 6 and a gas introducing part 10 covering the irradiating part on the substrate 6, furthermore having a window 9 introducing the laser light, provided with a blowoff nozzle 8 of a gaseous starting material toward the irradiating part and provided with an inlet port 4 along the circumference with the irradiating part as the center. The position close to the tip of the blowoff nozzle 8 of a gaseous starting material is provided with a backward nozzle 7 executing the blowoff of gas in the direction reverse to the blowoff direction.



DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the defective correction equipment of a photo mask used for semiconductor manufacture or manufacture of a liquid crystal display, and the laser assisted CVD system used for wiring correction of a liquid crystal substrate.

[0002]

[Description of the Prior Art] The laser assisted CVD system which corrects the defect on a substrate conventionally Irradiation optical system equipped with the laser radiation function which irradiates a laser light source and a laser beam on a laser substrate, and the microscope function for observation, The material gas supply unit which supplies CVD material gas, the exhaust air unit which makes exhaust gas harmless, It has the control unit which controls operation of the X-Y stage which positions and holds a substrate, the above-mentioned unit, etc., and in order to irradiate a laser beam, to confine material gas in the irradiation section on a substrate and to form a thin film in it, it has the structure where gas induction covers a substrate irradiation section top.

[0003] Here, the so-called chamber loess gas introduction method by the gas-curtain method which is small as for gas induction, and controls the gas stream of the gap between a substrate and gas induction, and it is made to shut up material gas as a gestalt which shortens the time which the substitution of the atmosphere of the irradiation section takes, and prevents mixing of the air from the circumference it was made to shut up gas locally is learned. This method is indicated by JP,8-222565,A by U.S. JP,4778693,B by Drozdowitz etc., JP,1-502149,A by big ZUIKU etc., Hongo, etc.

[0004] How to pass the gas in such gas induction is as follows. That is, gas induction prepares Mizogami's gas suction mouth in the circumference of the laser beam irradiation section of the nozzle which blows off material gas toward the laser beam irradiation section, and a substrate and the field which counters, and is arranged in a configuration which turned down the bowl to the substrate. Material gas is supplied by blowing off in the laser beam irradiation section by the nozzle, and, on the other hand, used material gas is recovered by the above-mentioned suction mouth. Since a suction mouth encloses the irradiation section, it serves also as the function to prevent the wraparound of the air which is going to enter through a gap with a substrate from the circumference of the irradiation section.

[0005] Moreover, when forming membranes using an optical CVD reaction using the ultraviolet light source etc., in order to prevent the cloudiness of the aperture of the induction of a laser beam, using the composition which sprays purge gas on a window part from another induction for nozzles is also indicated..

[0006]

[Problem(s) to be Solved by the Invention] However, the Prior art had the fault shown below. That is, when the rate of flow in the irradiation section of material gas is small, the decomposition product of the shape of a particle decomposed with Laser CVD lies on the circumference of the laser beam irradiation section, and the fault in which the correction section becomes dirty is produced. Although what is necessary is just to raise the rate of flow of material gas for on the other hand canceling this fault, in that case By the amount increase of blowdown from a raw material gas nozzle, near the blowdown section of a material gas blowdown nozzle A surrounding atmosphere is drawn in the direction of outgoing radiation of material gas, and a drawing-in style occurs around a diffuser. Consequently, a gas-curtain operation of the aeration prevention with a suction mouth collapses near the raw material nozzle, air enters into the laser beam irradiation section from there, and the problem on which the membraneous quality of a CVD film deteriorates is produced.

[0007] That is, by the conventional method, the trade-off with the aeration prevention effect by the gas-curtain operation when enlarging suppression and the rate of flow of rain intention-like

deposition of the laser beam irradiation section when making the rate of flow small was produced, and there was a fault incompatible with good deposition membraneous quality in suppression of rain intention-like deposition.
[0008] Although rain intention-like deposition can be removed by taking out and washing a substrate and there is that there is nothing, the new problem which spoils the simplicity and high through PU@TTO nature which are the feature of a laser assisted CVD system arises. [no] Moreover, although processing shaved off to the accuracy around a deposition film by laser steam fog method may be performed after CVD(ing) when correcting a detailed pattern like a semiconductor photo mask, when it lies and there is deposition, the detection precision of the edge of a pattern falls and there is also a fault from which exact processing position identification becomes difficult.
[0009] Furthermore, in performing blasting of the above-mentioned purge gas, material gas closes and it is further hard coming to do eye **. In performing purge gas blasting to a window part By the method of spraying purge gas on a window part from the diffuser of the shape of an another nozzle as known conventionally The flow of the gas by which purge gas flows toward outwardness focusing on a laser beam introduction optical axis in the state where it flowed into the gap between a substrate and gas induction for the sex for un-of the introductory direction of purge gas The bias was produced in the gas-curtain effect and the problem to which mixing of the air around a laser beam irradiation zone takes place was produced. This problem becomes remarkable especially, when producing the need of increasing the flow rate of purge gas, in order that the working distance of an objective lens may become short inevitably, consequently the distance of a window part and a substrate may avoid a mix lump of the material gas atmosphere to a place by the window in about 3mm and an extremely thin gap, when the about 100-time lens of a high scale factor needs to be used, in order to perform CVD of a detailed pattern.
[0010] this invention aims at the laser assisted CVD system aims at suppression and aeration prevention of rain intention-like deposition, and it was made not to produce a bias in a gas curtain by purge gas providing in view of an above-mentioned problem.
[0011]
[Means for Solving the Problem] this invention which attains the above-mentioned purpose consists of the following invention specification matter.
[0012] (1) The irradiation observation unit which can observe this irradiation section while irradiating the irradiation section of the request on the substrate which has arranged the laser beam by the laser light source and this laser light source on a stage, The gas supply unit which supplies CVD material gas to the irradiation section on the aforementioned substrate, In the laser assisted CVD system which has the aperture which introduces the aforementioned laser beam for the irradiation section on the aforementioned substrate with a wrap, and has the gas induction which was equipped with the blowdown nozzle of material gas towards the aforementioned irradiation section, and was further equipped with the suction mouth in accordance with the periphery centering on the aforementioned irradiation section It is characterized by equipping the nearest position to a nose of cam of the blowdown nozzle of the aforementioned material gas with the opposite direction nozzle which performs the gas blowdown of the direction of the blowdown of the aforementioned material gas, and an opposite direction.
[0013] (2) In the above (1), it is characterized by having a purge gas inlet so that it may face focusing on the optical axis of a laser beam more nearly mutually than the side of the aforementioned aperture.
[0014]
[Embodiments of the Invention] Here, an example of the gestalt of operation of this invention is explained with reference to drawing 1 - drawing 3 . Drawing 1 is the cross section showing the composition of the gas induction of an example at the time of applying to white defective correction of a semiconductor photo mask, and drawing 2 is the block diagram showing the composition of the whole laser assisted CVD system of an example. Drawing 3 is the ** type view of the result which asked for the situation of the wraparound of the air to the laser radiation section by the simulation by using as a model structure of gas induction shown in drawing 1 .

[0015] First, fundamental processing conditions are explained to be operation of the whole equipment using drawing 2 . It arranges so that the gas induction 10 may be hung on the substrate 6 which consists of a semiconductor photo-mask substrate of the 5 inch angle placed on X-Y stage 18. The gap interval of a substrate 6 and the gas induction 10 is 1mm. The gas supply unit 13 which supplies Cr (CO)6 of material gas, the argon gas of carrier gas, the argon gas of denial gas, and the argon gas of aperture purge gas, and the exhaust air unit 16 which processes exhaust gas are connected to the gas induction 10.
[0016] Q switch Nd: It is reflected by the mirror 15 and carry out incidence of the outgoing radiation light of the laser light source 14 which consists of the 3rd higher-harmonic light source of an YAG laser to the irradiation observation unit 17. The irradiation observation unit 17 operates a laser beam orthopedically by aperture, and it has the function to observe the pattern of the laser beam irradiation section at the same time it forms an irradiation pattern in the request section on a substrate 6 in a desired configuration. The objective lens arranged to the outgoing radiation side of the irradiation observation unit 17 is 100 times the scale factor of this, and the working distance is 5mm. Operation of the gas supply unit 13, the exhaust air unit 16, X-Y stage 18, and a laser light source 14 has composition controlled by the control unit 12.
[0017] Next, drawing 1 describes the structure of the gas induction 10. Like the above-mentioned, the gas induction 10 counters on a substrate 6, has an opening (for example, 1mm), and is arranged. It has the aperture 9 which draws a laser beam in the center in the GAZU induction 10, and, as for the substrate 6 to this aperture 9, the irradiation section will be located in it.
[0018] In the gas induction 10, four kinds of holes can open in the upper part, and it has the material gas entrance 2, the denial gas inlet 1, the aperture purge gas entrance 3, and the suction gas outlet 4. The material gas entrance 2 is ** entirety ****** to the 2nd nozzle 7 of the diameter of 2mm which negates ** entirety ****** and the denial gas inlet 1 to the blow and opposite direction of material gas at the 1st nozzle 8 of the diameter of 2mm that the level luffing motion of air should be prevented when [which blows off material gas in the laser radiation section] blowing off the material gas from the 1st nozzle 8 in the laser radiation section, and blows off gas, for example.
[0019] In this case, the 2nd nozzle 7 was located in the nearest to a diffuser nose of cam of the 1st nozzle 8, and the nozzle has turned to the retrose in the 1st nozzle 8. Therefore, material gas and the denial gas of opposite direction blow off to the material gas which blows and comes out of the 1st nozzle 8 at the latest of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne., and it is made to negate drawing in to material gas.
[0020] Moreover, the suction gas outlet 4 inhales the suction mouth 5 formed in the circumference of an aperture 9 in the opposed face with the substrate 6 of the gas induction 10, ** entirety ******, used material gas, and the air of the circumference of the irradiation section. Here, it absorbs in a position with a radius of 30mm from width of face of 2mm, and an optical-axis center, and has a mouth 5. It has the aperture purge gas entrance 3 so that purge gas may blow off along with an aperture 9 for antisticking of the material gas to an aperture 9, and ** entirety ******, this aperture purge gas entrance 3, and the aperture purge gas diffuser 11 may blow off from the back of a drawing toward this side like drawing 1 to the aperture purge gas diffuser 11 with which the side of an aperture 9 was equipped, and although it is not illustratable, it has the aperture purge gas entrance and aperture purge gas diffuser which blow off from drawing this side toward an aperture 9 in the cutting-into-half view Therefore, it has an aperture purge gas diffuser so that it may counter in the symmetrical direction focusing on the optical axis of an aperture 9, and it has a diffuser so that purge gas may collide. In addition, in drawing 1 , the connecting piping with the material gas supply unit 13 and the exhaust air unit 16 is omitted in order to make it intelligible.
[0021] The effect was verified by the experiment and the simulation of a gas stream using such the structure gas insertion section 10. The Leh light irradiation conditions in an experiment are as follows. 2kHz of repeats, 50ns of pulse width, irradiation on-the-strength 50 kW/cm2, 5 micrometer angle of irradiation shape of beam, and the assembly time were made into the range for 3 - 10 seconds, it lay at the time of changing a quantity of gas flow, and the grade of

membraneous degradation by aeration was evaluated. In addition, gas concentration of Cr (CO)6 of material gas was set to 0.2Torr(s) at the outlet of the 1st nozzle 8. In addition, the above-mentioned conditions are conditions which can obtain the deposition film which there is metallic luster and can take shading nature required for photo masks, when there is no mixing of air.
[0022] First, the verification result of the drawing-in prevention effect of the air by the 2nd nozzle 7 is described. When aperture purge gas flow rate 1000sccm and the amount of blowdown from the 2nd nozzle 7 changed 300sccm(s) and the material gas flow rate from the 1st nozzle between 100 - 800sccm(s), although the obtained deposition film was a metallic film without the influence of air, when the flow rate of the 1st nozzle was 500 or less sccms, the rain intention of the shape of a black particle was formed focusing on the downstream of the laser beam irradiation section. Next, when the blowdown of the gas from the 2nd nozzle 7 was stopped, the amount of blowdown of the material gas from the 1st nozzle 8 was transparent in 300 or more sccms, and the oxide film which is easy to peel was formed.
[0023] next, in order to verify the effect of the aeration by the asymmetry of purge gas blasting of an aperture, one side of the diffuser of two aperture purge gas was closed having used 700sccm(s) and the amount of blowdown from the 2nd nozzle as 300sccm(s) for the amount of raw material blowdown from the 1st nozzle 8, the purge gas flow rate was changed in the range which is 500 - 1000sccm, and the situation of deposition was investigated In this case, it turns out that a deposition film turns into an oxide film in all the purge gas flow rate ranges, and air enters a laser radiation field. Moreover, the cloudiness of an aperture arose [the purge gas flow rate] in 700 or less sccmks, and the bird clapper found the purge effect of an aperture insufficiently. Drawing 3 is the ** type view showing the result which carried out the simulation of the distribution of the air concentration by the flow of a gas stream by using as a model structure shown in the 1st.
[0024] Drawing 3 (a) is an air concentration distribution in case there is no denial nozzle by the conventional method, and drawing 3 (b) is an air concentration distribution in case there is a denial nozzle by this invention. When there is no denial nozzle, it turns out that it is dragged by surrounding atmosphere by the flow of the material gas which blew off from the 1st nozzle, consequently the gas-curtain effect collapses, a wraparound, consequently the air concentration of the laser radiation section rise by concentration with air concentration deep [to / near the laser radiation section], and the membraneous quality of a deposition film is degraded.
[0025]
[Effect of the Invention] Since mixing of air can be suppressed from the surroundings of gas induction according to the laser assisted CVD system by this invention, keeping high-speed the gas flow rate of the laser radiation section, the outstanding laser equipment which can obtain the deposition film which does not have a particle-like rain intention and does not have membraneous degradation can be offered. Moreover, in the laser assisted CVD system using an optical CVD reaction, since the symmetric property to the optical axis of the flow of the purge gas in gas induction and the gap between substrates is good when it applies to the composition using the purge gas to a window part, mixing of the air from the gas induction circumference to the laser beam irradiation section can be prevented, and the laser assisted CVD system which can introduce purge gas can be offered, without causing membraneous degradation.

[Translation done.]

CLAIMS

[Claim(s)]

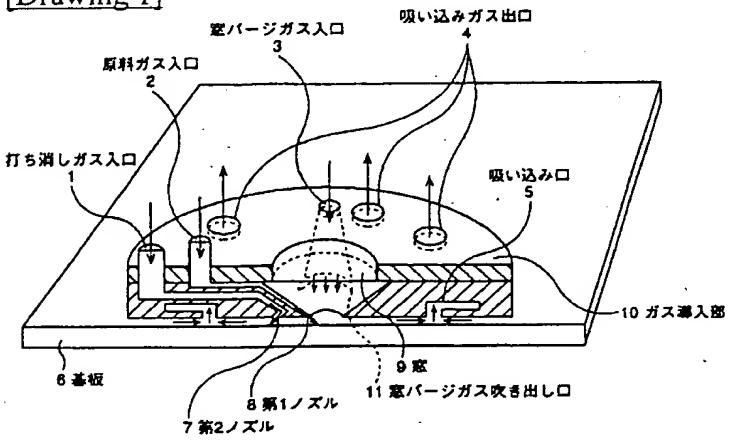
[Claim 1] Laser light source. The irradiation observation unit which can observe this irradiation section while irradiating the irradiation section of the request on the substrate which has arranged the laser beam by this laser light source on a stage. The gas supply unit which supplies CVD material gas to the irradiation section on the aforementioned substrate. It has the aperture which introduces the aforementioned laser beam for the irradiation section on the aforementioned substrate with a wrap, and has the blowdown nozzle of material gas towards the aforementioned irradiation section, the periphery centering on the aforementioned irradiation section is met further, and it is suction opening. It is the laser assisted CVD system equipped with the above, and is characterized by having the opposite direction nozzle which performs the gas blowdown of the direction of the blowdown of the aforementioned material gas, and an opposite direction in the nose-of-cam close position of the blowdown nozzle of the aforementioned material gas.

[Claim 2] The laser assisted CVD system according to claim 1 characterized by having a purge gas inlet so that it may face focusing on the optical axis of a laser beam more nearly mutually than the side of the aforementioned aperture.

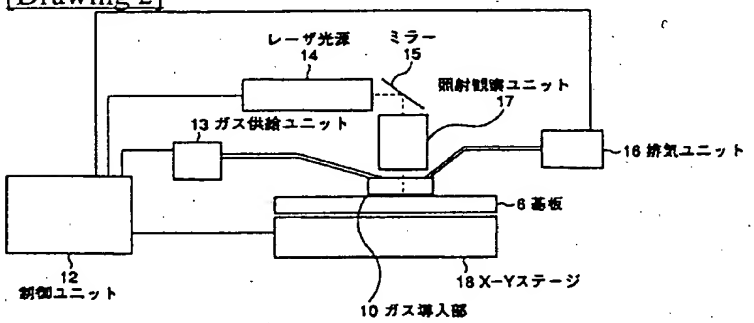
[Translation done.]

DRAWINGS

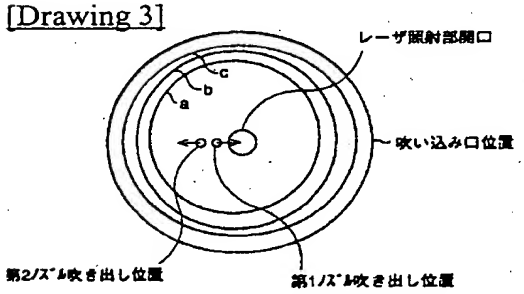
[Drawing 1]



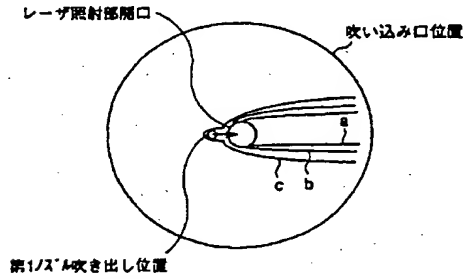
[Drawing 2]



[Drawing 3]



(b) 打ち消しノズルがある場合の空気濃度分布



(a) 打ち消しノズルがない場合の空気濃度分布

空気濃度分布の模式図
(a、b、cは等濃度曲線を示す。a、b、cの順に空気濃度が低い)

[Translation done.]